

# A NOTE CONCERNING THE PHYSICAL SIGNIFICANCE OF THE MEAN DIURNAL CURVE OF TEMPERATURE.

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The hourly average temperatures for the different months, or for the year, are sometimes subjected to elaborate processes of analysis for the purpose of eliciting, if possible, some relation bearing upon the enigma of the semi-diurnal oscillation of the barometer. But have these hourly averages any great scientific value? Is the mean diurnal curve of temperature, for example, that to which each daily curve tends to conform? Or, further, is the method of least squares applicable in the sense that the average value of all the observations is the most probable value? The original object of the present brief investigation was to test this point.

It is of course true that for any hour in any period, say a month, the sum of the squares of the deviations from the arithmetic mean temperature of that hour and month will be a minimum. For let  $T$  be the arithmetical mean temperature for any given hour of a month;  $t_1, t_2, t_3, \dots$  the individual temperatures for that hour for each day of the month;  $P$  the "most probable value" of the set of daily temperatures. Then—

$$S = (P - t_1)^2 + (P - t_2)^2 + \dots = \text{a minimum.}$$

$$\therefore \frac{dS}{dP} = 2nP - 2(t_1 + t_2 + t_3 + \dots) = 0.$$

$$\therefore P = (t_1 + t_2 + t_3 + \dots)/n = T.$$

This assumes, however, that each individual temperature is under some sort of compulsion to approximate to the mean value. There is no such compulsion, for the mean temperature curve of any assigned month in one year may be materially different from the mean temperature curve of that same month in any other year.

Any attempt to test the value of the arithmetic mean temperature in

a practical way must necessarily involve great labour. The method adopted here, after various unsatisfactory trials, is the following :—

Let  $t$  be the temperature at any hour on any day at Kimberley. Then the temperature  $t'$  at the next hour will depend partly upon  $t$  and partly upon the meteorological elements of wind and moisture coexisting. That is to say, for given wind and moisture conditions,  $t'$

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|         | XV.                | XVI.               | Diff.              |
|---------|--------------------|--------------------|--------------------|
|         | $t$ .              | $t'$ .             | $t - t'$ .         |
| 1.....  | 58 <sup>0</sup> ·5 | 57 <sup>0</sup> ·5 | +1 <sup>0</sup> ·0 |
| 2.....  | 61·0               | 60·2               | +0·8               |
| 3.....  | 62·4               | 61·2               | +1·2               |
| 4.....  | 66·5               | 65·3               | +1·2               |
| 5.....  | 71·0               | 69·2               | +1·8               |
| 6.....  | 74·4               | 73·5               | +0·9               |
| 7.....  | 71·0               | 69·5               | +1·5               |
| 8.....  | 65·7               | 64·8               | +0·9               |
| 9.....  | 62·8               | 61·8               | +1·0               |
| 10..... | 55·3               | 57·0               | -1·7               |
| 11..... | 60·8               | 61·0               | -0·2               |
| 12..... | 62·0               | 63·6               | -1·6               |
| 13..... | 68·0               | 66·9               | +1·1               |
| 14..... | 54·0               | 53·0               | +1·0               |
| 15..... | 46·0               | 45·2               | +0·8               |
| 16..... | 58·0               | 58·0               | 0·0                |
| 17..... | 59·2               | 59·0               | +0·2               |
| 18..... | 60·0               | 58·9               | +1·1               |
| 19..... | 63·3               | 62·9               | +0·4               |
| 20..... | 66·5               | 66·0               | +0·5               |
| 21..... | 54·4               | 55·0               | -0·6               |
| 22..... | 70·0               | 69·2               | +0·8               |
| 23..... | 73·0               | 71·0               | +2·0               |
| 24..... | 72·3               | 72·0               | +0·3               |
| 25..... | 73·7               | 71·0               | +2·7               |
| 26..... | 58·5               | 58·5               | 0·0                |
| 27..... | 55·8               | 59·0               | -3·2               |
| 28..... | 54·0               | 53·0               | +1·0               |
| 29..... | 62·8               | 61·1               | +1·7               |
| 30..... | 64·0               | 65·2               | -1·2               |
| 31..... | 57·4               | 57·0               | +0·4               |
|         | 62·7               | 62·1               | 0·6                |

will be higher or lower according as  $t$  is higher or lower. We have then to find the most common value of  $t - t'$  at any hour. For if the mean diurnal curve of temperature has a real physical significance the most common successive hourly values of  $t - t'$  should give the same curve.

On account of the great labour of the inquiry it has only been possible to prosecute it for the months of January (as representing the summer) and July (as representing the winter). But for these two months it has been done for ten whole years of hourly temperature readings. As an illustrative example of the method the foregoing table will perhaps be sufficient.

Here the first column gives the dates; the second and third columns the Kimberley temperatures at 3 p.m. and 4 p.m.; the fourth column the differences, counted positive when  $t$  is the greater. When each July of the ten years 1902-11 has been treated in this way, particular values of  $t - t'$  are counted and the total frequencies arranged in rows in the following way :—

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| $t - t'$ .    | No. | $t - t'$ .        | No. |
|---------------|-----|-------------------|-----|
| Less than 0°0 | 24  | 1°3               | 8   |
| 0°0           | 14  | 1°4               | 5   |
| 0°1           | 10  | 1°5               | 14  |
| 0°2           | 6   | 1°6               | 5   |
| 0°3           | 15  | 1°7               | 7   |
| 0°4           | 18  | 1°8               | 10  |
| 0°5           | 11  | 1°9               | 6   |
| 0°6           | 17  | 2°0               | 5   |
| 0°7           | 14  | 2°1               | 4   |
| 0°8           | 19  | 2°2               | 6   |
| 0°9           | 16  | 2°3               | 4   |
| 1°0           | 20  | 2°4               | 4   |
| 1°1           | 14  | Greater than 2°4° | 20  |
| 1°2           | 14  |                   |     |

That is to say, in the ten years 1902-11, between the hours 3 p.m. and 4 p.m., the temperature fell, for example, by 0°3, 15 times; by 0°9, 16 times; by 2°0, 5 times, and so on. In the Tables at the end will be found the total frequencies for each hour, arranged in sets of five consecutive differences.

A remarkable feature of the results given in these Tables is the fact that over a wide range of temperature differences there is no strong central value about which the frequencies cluster. It is, in fact, not possible to

construct a satisfactory temperature curve based upon the most common differences of temperature between one hour and the next. There are some weak central values which, to some extent, disappear in the process of smoothing by Bloxam's method. If I am not mistaken these arise largely from a tendency to a concentration of the frequencies round differences of whole degrees. Every reader of a meteorological thermometer probably has more entries in his register in whole degrees than in any fraction thereof: *e.g.*,  $50^{\circ}0$  will occur more often than, say,  $50^{\circ}2$ ; and  $48^{\circ}0$  more often than, say,  $47^{\circ}9$ . Consequently the difference  $2^{\circ}0$  will occur more often than, say,  $1^{\circ}3$ . This is to be expected in a way, because the etched division indicating the degree, however fine it may be, has some breadth, and so takes up more of the scale than the imaginary divisions

## JULY TEMPERATURE VARIATION.

| Hour Ending    | Normal Curve. | Component Curves. |               |                 |
|----------------|---------------|-------------------|---------------|-----------------|
|                |               | A.                | B.            | C.              |
|                | $t-t'$ .      | $t-t'$ .          | $t-t'$ .      | $t-t'$ .        |
| I. ....        | $+1^{\circ}2$ | $+0^{\circ}1$     | $+1^{\circ}1$ | $+2^{\circ}0$   |
| II. ....       | $+1^{\circ}0$ | $+0^{\circ}1$     | $+1^{\circ}1$ | $+2^{\circ}1$   |
| III. ....      | $+0^{\circ}7$ | $-0^{\circ}1$     | $+0^{\circ}9$ | $+1^{\circ}9$   |
| IV. ....       | $+1^{\circ}0$ | $+0^{\circ}2$     | $+1^{\circ}2$ | $-1^{\circ}9$   |
| V. ....        | $+0^{\circ}7$ | $0^{\circ}0$      | $+0^{\circ}9$ | $+1^{\circ}9$   |
| VI. ....       | $+0^{\circ}5$ | $+0^{\circ}1$     | $+1^{\circ}0$ | $(+1^{\circ}6)$ |
| VII. ....      | $+0^{\circ}7$ | $0^{\circ}0$      | $+0^{\circ}9$ | $+2^{\circ}0$   |
| VIII. ....     | $-4^{\circ}3$ | $-3^{\circ}0$     | $-4^{\circ}0$ | $-5^{\circ}0$   |
| IX. ....       | $-8^{\circ}0$ | $(-6^{\circ}9)$   | $-7^{\circ}9$ | $-8^{\circ}9$   |
| X. ....        | $-5^{\circ}5$ | $-5^{\circ}0$     | $-6^{\circ}1$ | $-6^{\circ}9$   |
| XI. ....       | $+4^{\circ}2$ | $-3^{\circ}1$     | $-4^{\circ}0$ | $-4^{\circ}9$   |
| Noon. ....     | $-3^{\circ}0$ | $-2^{\circ}3$     | $-3^{\circ}1$ | $-3^{\circ}8$   |
| XIII. ....     | $-2^{\circ}0$ | $-1^{\circ}3$     | $-2^{\circ}0$ | $-2^{\circ}7$   |
| XIV. ....      | $-1^{\circ}2$ | $0^{\circ}0$      | $-1^{\circ}1$ | $-1^{\circ}8$   |
| XV. ....       | $-0^{\circ}3$ | $+0^{\circ}3$     | $-0^{\circ}3$ | $-0^{\circ}9$   |
| XVI. ....      | $+1^{\circ}0$ | $(+1^{\circ}6)$   | $+0^{\circ}9$ | $0^{\circ}0$    |
| XVII. ....     | $+5^{\circ}3$ | $+3^{\circ}0$     | $+5^{\circ}0$ | $+5^{\circ}8$   |
| XVIII. ....    | $+6^{\circ}1$ | $+4^{\circ}5$     | $+5^{\circ}9$ | $+7^{\circ}0$   |
| XIX. ....      | $+2^{\circ}8$ | $+1^{\circ}9$     | $+3^{\circ}0$ | $+3^{\circ}5$   |
| XX. ....       | $+2^{\circ}0$ | $+1^{\circ}0$     | $+2^{\circ}0$ | $+2^{\circ}9$   |
| XXI. ....      | $+1^{\circ}7$ | $0^{\circ}0$      | $+1^{\circ}9$ | $+2^{\circ}9$   |
| XXII. ....     | $+1^{\circ}4$ | $+0^{\circ}1$     | $+1^{\circ}1$ | $+1^{\circ}9$   |
| XXIII. ....    | $+1^{\circ}2$ | $+0^{\circ}1$     | $+0^{\circ}9$ | $+2^{\circ}0$   |
| Midnight ..... | $+1^{\circ}2$ | $+0^{\circ}1$     | $+1^{\circ}0$ | $+1^{\circ}9$   |

## JANUARY TEMPERATURE VARIATION.

| Hour Ending   | Normal Curve.     | Component Curves. |                   |                   |
|---------------|-------------------|-------------------|-------------------|-------------------|
|               |                   | A.                | B.                | C.                |
|               | $t-t'$ .          | $t-t'$ .          | $t-t'$ .          | $t-t'$ .          |
| I. ....       | +1.2 <sup>o</sup> | +0.1 <sup>o</sup> | +0.9 <sup>o</sup> | +1.9 <sup>o</sup> |
| II. ....      | +1.1              | +0.2              | +1.2              | +2.0              |
| III. ....     | +0.9              | +0.4              | +0.9              | +1.8              |
| IV. ....      | +0.9              | +0.2              | +1.2              | (+2.0)            |
| V. ....       | +0.8              | +0.1              | +0.9              | +1.8              |
| VI. ....      | -0.8              | -0.1              | -1.0              | -2.0              |
| VII. ....     | -5.0              | -4.0              | -5.0              | -5.9              |
| VIII. ....    | -4.4              | -3.1              | -4.0              | -5.4              |
| IX. ....      | -3.6              | -3.0              | -4.0              | -4.9              |
| X. ....       | -3.0              | ?                 | -3.0              | -4.1              |
| XI. ....      | -2.8              | -2.1              | -2.9              | -3.4              |
| Noon. ....    | -1.8              | -1.2              | -2.3              | -2.9              |
| XIII. ....    | -1.1              | -1.2              | -1.8              | -2.4              |
| XIV. ....     | -0.4              | -1.1              | -0.3              | +0.3              |
| XV. ....      | +0.1              | -0.9              | 0.0               | +1.0              |
| XVI. ....     | +0.9              | +0.1              | +0.9              | +1.9              |
| XVII. ....    | +1.5              | +1.0              | +1.8              | ?                 |
| XVIII. ....   | +2.3              | +1.1              | +2.0              | +2.9              |
| XIX. ....     | +4.0              | +3.1              | +4.0              | +5.0              |
| XX. ....      | +3.1              | +2.1              | +2.9              | +4.0              |
| XXI. ....     | +2.0              | +1.0              | +2.1              | +3.0              |
| XXII. ....    | +1.5              | +0.1              | +0.9              | +1.9              |
| XXIII. ....   | +1.4              | 0.0               | +0.9              | +2.0              |
| Midnight .... | +1.3              | 0.0               | +1.0              | +1.9              |

that indicate the tenths, and hence readings to whole degrees should be the most frequent.\* Apart from this, however, it is not unlikely that what is called the mean diurnal curve of temperature is, for Kimberley, made up of at least three superimposed component curves of the same period—curves proper perhaps to various outstanding types of weather. They are given below in smoothed values of  $t-t'$ , but rather in the way of inference from the results than of proof; and also, for comparison, the corresponding differences of the normal mean diurnal temperature curve. Of these three, marked A, B, and C respectively, the B curve resembles the normal curve; the A curve is probably proper to damp weather; while the C

\* At any rate this is the most important reason.

curve may represent dry anti-cyclonic conditions. Whatever be the actual value of these three component curves, it seems clear that the normal mean diurnal temperature curve has no very important physical significance over and above what the B curve may have.

NOTE.—In the Tables of frequency-values of  $t-t'$  at the end, there is a line marked "Less" at the top, and a line marked "Greater" at the bottom. The numbers in these lines are residuals, outside the range of the numbers in the body of the Tables. Thus, *e.g.*, between 2 p.m. and 3 p.m. in July there were—

|    |       |      |     |             |      |    |                  |    |                  |   |
|----|-------|------|-----|-------------|------|----|------------------|----|------------------|---|
| 34 | times | when | the | temperature | rose | by | 1.1 <sup>o</sup> | to | 1.5 <sup>o</sup> | ; |
| 69 | "     | "    | "   | "           | "    | "  | 0.6              | "  | 1.0              | ; |
| 76 | "     | "    | "   | "           | "    | "  | 0.1              | "  | 1.5              | ; |
| 61 | "     | "    | "   | "           | fell | "  | 0.0              | "  | 0.4              | ; |
| 25 | "     | "    | "   | "           | "    | "  | 0.5              | "  | 0.9              | . |

Besides this there were 45 residual frequencies, *i.e.*, 19 occasions when the rise was greater than 1.5, and 26 occasions when the fall exceeded 0.9.

JANUARY. FREQUENCY-VALUES OF  $t - t'$ .

|               | M. | I. | II. | III. | IV. | V. | VI. | VII. | VIII. | IX. | X. | XI. | N. | XIII. | XIV. | XV. | XVI. | XVII. | XVIII. | XIX. | XX. | XXI. | XXII. | XXIII. | M. |
|---------------|----|----|-----|------|-----|----|-----|------|-------|-----|----|-----|----|-------|------|-----|------|-------|--------|------|-----|------|-------|--------|----|
| Less.....     | 18 | 22 | 34  | 26   | 27  | 20 | 40  | 48   | 17    | 30  | 23 | 26  | 29 | 17    | 38   | 26  | 40   | 21    | 62     | 34   | 51  | 16   | 23    | 11     |    |
| -8.0 to       |    |    |     |      |     |    | 19  |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -7.5 "        |    |    |     |      |     |    | 17  |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -7.0 "        |    |    |     |      |     |    | 22  |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -6.5 "        |    |    |     |      |     |    | 13  |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -6.0 "        |    |    |     |      |     |    | 31  | 25   |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -5.5 "        |    |    |     |      |     |    | 18  | 29   | 12    |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -5.0 "        |    |    |     |      |     |    | 32  | 32   | 46    |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -4.5 "        |    |    |     |      |     |    | 13  | 42   | 35    | 31  | 22 |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -4.0 "        |    |    |     |      |     |    | 23  | 41   | 53    | 51  | 33 |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -3.5 "        |    |    |     |      |     |    | 13  | 23   | 38    | 53  | 52 | 18  | 23 | 21    |      |     |      |       |        |      |     |      |       |        |    |
| -3.0 "        |    |    |     |      |     |    | 14  | 24   | 45    | 56  | 47 | 70  | 45 | 31    |      |     |      |       |        |      |     |      |       |        |    |
| -2.5 "        |    |    |     |      |     |    | 5   | 15   | 18    | 32  | 36 |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -2.0 "        |    |    |     |      |     |    | 30  |      |       |     |    | 36  | 59 | 54    | 46   |     |      |       |        |      |     |      |       |        |    |
| -1.5 "        |    |    |     |      |     |    | 44  |      |       |     |    | 14  | 37 | 37    | 60   | 39  |      |       |        |      |     |      |       |        |    |
| -1.0 "        |    |    |     |      |     |    | 66  |      |       |     |    | 14  | 35 | 41    | 35   | 14  |      |       |        |      |     |      |       |        | 4  |
| -0.5 "        |    |    |     |      |     |    | 43  |      |       |     |    |     | 18 | 37    | 37   | 35  | 18   |       |        |      |     |      |       |        |    |
| +0.0 "        |    |    |     |      |     |    | 41  |      |       |     |    |     | 9  | 20    | 36   | 46  | 38   | 11    |        |      |     |      |       |        |    |
| +0.5 "        |    |    |     |      |     |    | 24  |      |       |     |    |     | 15 | 18    | 38   | 47  | 14   |       |        |      |     |      |       |        |    |
| 1.0 "         |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 1.5 "         |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 2.0 "         |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 2.5 "         |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 3.0 "         |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 3.5 "         |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 4.0 "         |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 4.5 "         |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| +5.0 "        |    |    |     |      |     |    |     |      |       |     |    |     |    |       |      |     |      |       |        |      |     |      |       |        |    |
| Greater ..... | 35 | 31 | 25  | 20   | 21  | 29 | 49  | 31   | 31    | 57  | 44 | 42  | 55 | 51    | 57   | 58  | 46   | 31    | 75     | 45   | 45  | 50   | 50    | 40     |    |

JULY. FREQUENCY-VALUES OF  $t - t'$ .

| M.                   | I. | II. | III. | IV. | V. | VI. | VII. | VIII. | IX. | X. | XL | N. | XIII. | XIV. | XV. | XVI. | XVII. | XVIII. | XIX. | XX. | XXI. | XXII. | XXIII. | M. |
|----------------------|----|-----|------|-----|----|-----|------|-------|-----|----|----|----|-------|------|-----|------|-------|--------|------|-----|------|-------|--------|----|
| Less.....            | 25 | 27  | 42   | 32  | 34 | 47  | 21   | 11    | 52  | 30 | 16 | 26 | 15    | 21   | 19  | 24   | 24    | 17     | 17   | 29  | 22   | 28    | 29     | 19 |
| -10.5 to -10.1 ..... |    |     |      |     |    |     |      |       | 15  |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -10.0 " 9.6 .....    |    |     |      |     |    |     |      |       | 29  |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -9.5 " 9.1 .....     |    |     |      |     |    |     |      |       | 13  |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -9.0 " 8.6 .....     |    |     |      |     |    |     |      |       | 31  |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -8.5 " 8.1 .....     |    |     |      |     |    |     |      |       | 21  |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -8.0 " 7.6 .....     |    |     |      |     |    |     |      |       | 39  |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -7.5 " 7.1 .....     |    |     |      |     |    |     |      |       | 12  | 17 |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -7.0 " 6.6 .....     |    |     |      |     |    |     |      | 18    | 17  |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -6.5 " 6.1 .....     |    |     |      |     |    |     |      | 15    | 10  | 39 | 11 |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -6.0 " 5.6 .....     |    |     |      |     |    |     |      | 24    | 18  | 44 | 23 |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -5.5 " 5.1 .....     |    |     |      |     |    |     |      | 21    | 6   |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -5.0 " 4.6 .....     |    |     |      |     |    |     |      | 40    |     | 32 | 50 |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -4.5 " 4.1 .....     |    |     |      |     |    |     |      | 30    | 41  | 29 |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| -4.0 " 3.6 .....     |    |     |      |     |    |     |      | 40    |     | 14 | 40 | 59 |       |      |     |      |       |        |      |     |      |       |        |    |
| -3.5 " 3.1 .....     |    |     |      |     |    |     |      | 23    |     | 14 | 28 | 53 | 31    |      |     |      |       |        |      |     |      |       |        |    |
| -3.0 " 2.6 .....     |    |     |      |     |    |     |      | 23    |     | 9  | 26 | 47 | 55    |      |     |      |       |        |      |     |      |       |        |    |
| -2.5 " 2.1 .....     |    |     |      |     |    |     |      | 18    |     | 8  | 14 | 40 | 42    | 27   |     |      |       |        |      |     |      |       |        |    |
| -2.0 " 1.6 .....     |    |     |      |     |    |     |      |       |     | 5  | 11 | 23 | 62    | 58   |     |      |       |        |      |     |      |       |        |    |
| -1.5 " 1.1 .....     |    |     |      |     |    |     |      |       |     |    |    | 11 | 13    | 47   | 74  |      |       |        |      |     |      |       |        |    |
| -1.0 " 0.6 .....     |    |     |      |     |    |     |      |       |     |    |    | 11 | 16    | 33   |     |      |       |        |      |     |      |       |        |    |
| -0.5 " -0.1 .....    | 19 | 16  | 28   | 18  | 32 | 21  | 26   |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 0.0 " +0.4 .....     | 32 | 43  | 45   | 53  | 46 | 70  | 59   |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| +0.5 " 0.9 .....     | 38 | 40  | 72   | 38  | 75 | 60  | 54   |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 1.0 " 1.4 .....      | 69 | 86  | 45   | 80  | 48 | 56  | 55   |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 1.5 " 1.9 .....      | 57 | 27  | 45   | 31  | 34 | 23  | 31   |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 2.0 " 2.4 .....      | 36 | 37  | 14   | 25  | 21 | 18  | (30) |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 2.5 " 2.9 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 3.0 " 3.4 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 3.5 " 3.9 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 4.0 " 4.4 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 4.5 " 4.9 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 5.0 " 5.4 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 5.5 " 5.9 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 6.0 " 6.4 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| 6.5 " 6.9 .....      |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| +7.0 " +7.9 .....    |    |     |      |     |    |     |      |       |     |    |    |    |       |      |     |      |       |        |      |     |      |       |        |    |
| Greater .....        | 34 | 34  | 19   | 33  | 20 | 15  | 18   | 40    | 41  | 5  | 18 | 9  | 13    | 35   | 26  | 20   | 34    | 34     | 20   | 14  | 22   | 23    | 16     | 24 |